

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
4 August 2005 (04.08.2005)

PCT

(10) International Publication Number  
**WO 2005/069964 A3**

(51) International Patent Classification<sup>7</sup>: B01L 3/00, (US). KOTZ, Kenneth, T. [US/US]; 330 Chenery Street, San Francisco, CA 94131 (US). NOBLE, Kyle [US/US]; 6923 Basilwood, San Antonio, TX 78213 (US).

(21) International Application Number: PCT/US2005/002033 (74) Agent: RODRIGUEZ, Michael A.; Guerin & Rodriguez, LLP, 5 Mount Royal Avenue, Mount Royal Office Park, Marlborough, MA 01752 (US).

(22) International Filing Date: 21 January 2005 (21.01.2005) (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(25) Filing Language: English (82) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH,

(26) Publication Language: English

(30) Priority Data: 60/538,951 23 January 2004 (23.01.2004) US

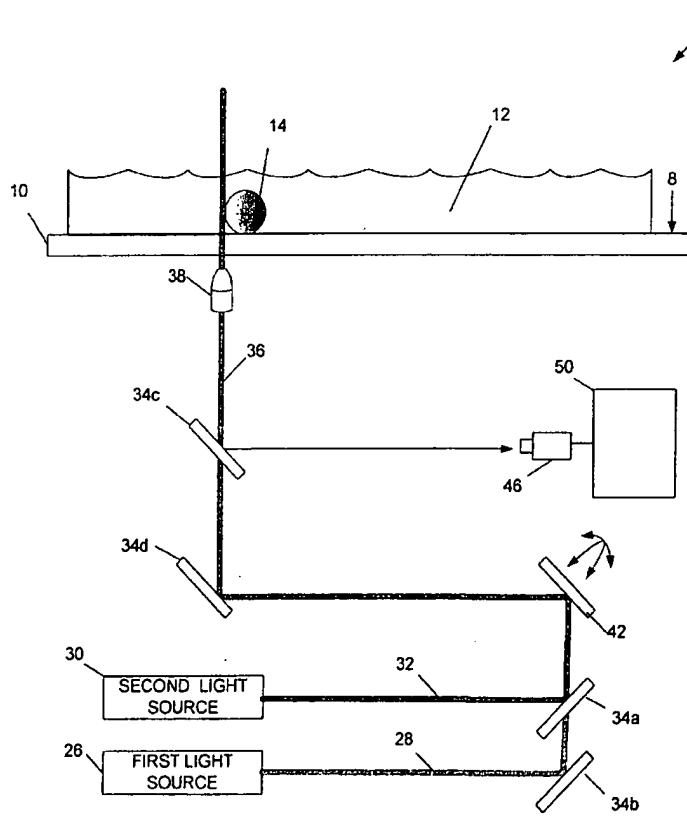
(71) Applicant (for all designated States except US): SRI INTERNATIONAL [US/US]; 333 Ravenswood Avenue, Menlo Park, CA 94025 (US).

(72) Inventors; and (75) Inventors/Applicants (for US only): FARIS, Gregory [US/US]; 2042 Santa Cruz Avenue, Menlo Park, CA 94025 (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH,

[Continued on next page]

(54) Title: APPARATUS AND METHOD OF MOVING MICRO-DROPLETS USING LASER-INDUCED THERMAL GRADIENTS

WO 2005/069964 A3



(57) Abstract: Described are an apparatus (4) and method of moving micro-droplets. A surface (8) has a liquid phase (12) thereon. In the liquid phase is a droplet (14). Focused at an edge of the droplet is a beam of light (28). The light beam produces a thermal gradient sufficient to induce the droplet (14) to move according to the Marangoni effect. The movement-inducing thermal gradient may appear within the droplet or within the liquid phase. The composition of the droplet, the liquid phase, and wavelength of the light beam can cooperate to cause heating within the droplet, liquid phase, or both. For example, an infrared laser can cause vibration of an O-H stretch in an aqueous droplet (or in the liquid phase). As another example, adding dye to a droplet or to the liquid phase enables absorption of light from an Argon ion laser. The apparatus and method find particular use in biological and chemical high-throughput assays.



GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:  
22 September 2005

**Published:**

— with international search report

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
4 August 2005 (04.08.2005)

PCT

(10) International Publication Number  
WO 2005/069964 A2

(51) International Patent Classification: Not classified (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(21) International Application Number: PCT/US2005/002033

(22) International Filing Date: 21 January 2005 (21.01.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data: 60/538,951 23 January 2004 (23.01.2004) US

(71) Applicant (for all designated States except US): SRI INTERNATIONAL [US/US]; 333 Ravenswood Avenue, Menlo Park, CA 94025 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): FARIS, Gregory [US/US]; 2042 Santa Cruz Avenue, Menlo Park, CA 94025 (US). KOTZ, Kenneth, T. [US/US]; 330 Chenery Street, San Francisco, CA 94131 (US). NOBLE, Kyle [US/US]; 6923 Basilwood, San Antonio, TX 78213 (US).

(74) Agent: RODRIGUEZ, Michael, A.; Guerin & Rodriguez, LLP, 5 Mount Royal Avenue, Mount Royal Office Park, Marlborough, MA 01752 (US).

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.



A2  
WO 2005/069964

(54) Title: APPARATUS AND METHOD OF MOVING MICRO-DROPLETS USING LASER-INDUCED THERMAL GRADIENTS

(57) Abstract: Described are an apparatus and method of moving micro-droplets. A surface has a liquid phase thereon. In the liquid phase is a droplet. Focused at an edge of the droplet is a beam of light. The light beam produces a thermal gradient sufficient to induce the droplet to move according to the Marangoni effect. The movement-inducing thermal gradient may appear within the droplet or within the liquid phase. The composition of the droplet, the liquid phase, and wavelength of the light beam can cooperate to cause heating within the droplet, liquid phase, or both. For example, an infrared laser can cause vibration of an O-H stretch in an aqueous droplet (or in the liquid phase). As another example, adding dye to a droplet or to the liquid phase enables absorption of light from an Argon ion laser. The apparatus and method find particular use in biological and chemical high-throughput assays.